

Mullite-containing coatings for inorganic fibers and ceramic matrix composites

Description of Technology: A ceramic matrix composite article comprised of inorganic fibers having a mullite-containing coating disposed within a matrix phase. The invention also provides a method for mating such an article, as well as for preparing a fiber having a mullite-containing coating. The mullite-containing coating on inorganic fibers within a matrix acts as a debonding coating, and the ceramic matrix composite article exhibits high strength and fracture toughness, even at elevated temperatures.

Patent Listing:

1. **US Patent No.** 6,022,621, Issued on February 8, 2000, "Mullite-containing coatings for inorganic fibers and ceramic matrix composites"

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Market Potential: Fiber-reinforced ceramic matrix composites comprising glass-ceramic matrices are known in the art. Fiber-reinforced ceramic matrix composites are useful as structural elements in high temperature environments such as heat engines. For these and other applications, the materials to be employed must exhibit good strength and toughness at ambient as well as elevated temperatures.

An important problem which has been identified in silicon carbide fiber reinforced ceramic matrix composites, particularly after exposure to temperatures above about 800.degree. C. in an oxidizing environment, is that microcracks can form causing embrittlement. Instead of exhibiting increased toughness and strength after exposure to high temperatures, the materials become brittle and are subject to catastrophic breakage, rather than more gradual failure as is typical of the original material. These physical problems can be attributed, in-part, to the effect of the interface between the silicon carbide fibers and the ceramic matrix composite.

At present, however, there are only a few other successful coating materials, most notably, carbon, although some success has been reported with metallic and porous coatings. In most of the composite systems that have been studied to date, exposure of the coating to high temperatures in air seriously degrades its properties. For example, in the case of lithium aluminum silicate matrix reinforced with carbon-coated silicon carbide fibers, heat treatment in air leads to a strong SiO.sub.2 interface, and the material loses its quasi-brittle mechanical properties. There is therefore great interest in developing alternative coatings for fibers in brittle-matrix composites

Benefits:

Strong and tough after exposure to high temperatures

Applications:

Heat engines